

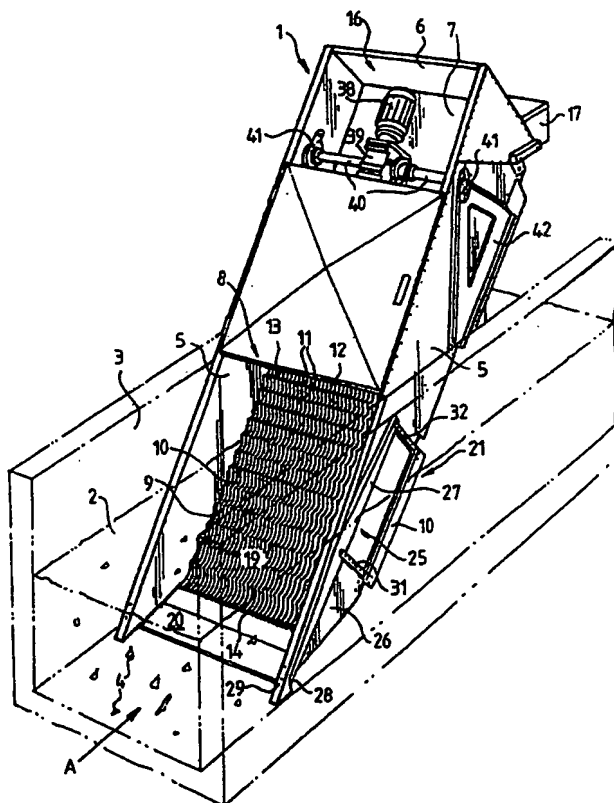


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(21) International Application Number: PCT/SE99/00228 (22) International Filing Date: 19 February 1999 (19.02.99) (30) Priority Data: 9800479-9 19 February 1998 (19.02.98) SE (71) Applicant (for all designated States except US): MELLEGÅRD VA-MASKINER AB [SE/SE]; Västerångsvägen 10, S-542 35 Mariestad (SE). (72) Inventor; and (75) Inventor/Applicant (for US only): MELLEGÅRD, Per [SE/SE]; Karl Magnussons väg 7, S-541 47 Skövde (SE). (74) Agent: AWAPATENT AB; P.O. Box 11394, S-404 28 Göteborg (SE).		(81) Designated States: AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> <i>In English translation (filed in Swedish).</i>

(54) Title: SEPARATING GRID**(57) Abstract**

In a separating grid (1) for collection and removal of solid particles and objects (4) present in running water (2) and equipped with a separating unit (8) comprising alternate fixed and mobile grid bars (9 and 10, respectively), wherein the mobile grid bars (10) are connected at their upper parts (18) to a drive unit (16) to draw the solid particles and objects (4) step by step out of the water (2) and carry them along the fixed grid bars (9), up to an outlet (17), the mobile grid bars (10) are suspended in the area of their lower parts (19) from a cradle (21) disposed at the lower part (20) of the separating grid (1). Said cradle (21) comprises suspension units (25) on both sides of the separating unit (8), and each suspension unit (25) may comprise an upper rocker arm (27) the lower end (28) of which is articulated to the lower end (29) of the separating grid (1), and also two rocker links (31, 32) articulated at their upper ends to the rocker arm (27) at a point intermediate the upper and lower ends (28, 34) of said arm and the lower ends (35) to the mobile grid bars (10).



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SEPARATING GRIDTechnical Field

The present invention relates to a separating grid for collection and removal of solid particles and objects present in running water, said grid being equipped with a separating unit arranged in a position of inclination obliquely upwards, rearwards in the direction of flow of the water and comprising alternate fixed and mobile grid bars formed with collection and removal means on those grid bar edges that are turned towards the direction of flow of the water, said mobile grid bars being connected to a drive unit in the area of their upper parts and arranged to be actuated by said unit in order to draw the solid particles and objects step by step out of the water and carry them along the fixed grid bars, up to an outlet.

Prior-Art Technology

A separating grid of the kind defined above is known from SE-C 470 102. According to this prior-art construction, the lower ends of the mobile grid bars are arranged to be so guided in the separating grid that they are given an essentially to-and-fro movement therein by the drive unit. More precisely, the mobile grid bars are supported on a cross piece, which is mounted at the bottom of the grid for controlled movement therein. The cross piece extends crosswise relative to the separating unit and it is formed at its short sides with downwardly directed guide profile members, each one of which is formed with a longitudinal groove. Each groove receives for controlled sliding motion therein a grid-mounted guide rail, each one of which is associated with its respective one of the guide profile members.

Owing to the arrangement of mounting the cross piece, and consequently the mobile grid bars, for controlled sliding motion, an arrangement which imparts

comparatively large to-and-fro movements to these components, and owing to the environment at the lowermost end of the separating unit, which environment includes large quantities of solid particles and objects, not to
5 speak of hard objects, such as stones and grit and the like, these sliding support means are exposed to considerable wear with consequential increased maintenance and repair costs. In addition, under the influence for instance of the relatively high speed of the flowing
10 water, hard objects may get wedged or caught in some other way between the guide rails and the grooves or other movable parts of the sliding support means and in doing so cause damage to these means and/or block the mobile grid bars. In turn, this may lead to breakdown of
15 the entire separating grid, with consequential problems in the form of damming-up of solid particles and objects, loss of production, and so on.

Summary of the Invention

The main object on which the invention is based is
20 to remove the deficiencies and drawbacks outlined above with respect of wear and damage to the sliding support means at the lowermost end of the separating unit.

This object is achieved in accordance with the invention by suspending the mobile grid bars, in the area
25 of their lower part, from a cradle disposed at the lower part of the separating grid, said cradle comprising suspension units on both sides of the separating unit.

In accordance with a first particularly preferred embodiment each suspension unit preferably comprises on
30 the one hand a rocker arm the lower end of which is articulated to the lower end of the separating grid, and on the other two rocker links the upper ends of which are articulated to the rocker arm at a point intermediate the upper and lower ends of said arm and the opposite ends of
35 which are attached to the mobile grid bars.

In accordance with a second particularly preferred embodiment each suspension unit may comprise a rod member

the lower end of which is articulated to the lower end of the separating grid, as well as a tubular member, which is mounted on the rod member for longitudinal sliding movement thereon, and a transmission means which is
5 stationarily mounted between the tubular member and the mobile grid bars.

Brief Description of the Drawings

The invention will be described in more detail in the following with reference to the accompanying
10 drawings, wherein:

Fig 1 is a schematic perspective view as seen obliquely from the front of a separating grid in accordance with a presently particularly preferred embodiment, said separating grid being shown positioned
15 in a channel of running water, with some of its parts having been removed for the sake of clarity,

Fig 2 is a lateral view of the separating grid of Fig 1, and

Fig 3 is a lateral projection corresponding to Fig 2
20 of the separating grid in accordance with a presently particularly preferred embodiment.

Description of Preferred Embodiments

The separating grid which is designated generally by numeral reference 1, is intended to be installed for
25 example in a water purification plant. Its purpose is to collect and remove solid particles and objects 4 present in running sewage water 2 in a channel 3 made from e.g. concrete or the like. The particles and objects are removed by means of a conveyor, not shown, for further
30 treatment and/or deposition.

Generally speaking, the separating grid 1 is designed as a frame structure constructed from frame profile sections, not shown in closer detail. Cover plates, such as lateral plate 5, end-wall plates 6 and bottom plates 7
35 are attached to the profile sections e.g. by means of screw and/or spot weld joints. The frame structure including the frame profile sections and the plates

preferably are made from a non-corrosive material, such as stainless steel or some other material that is resistant to the effects of the running water 2 and its contents. The side plates 5 form the lateral delimiting walls of the separating grid 1, whereas the end and bottom plates 6, 7 delimit the upper rear wall and the upper bottom wall, respectively, of the separating grid.

Intermediate its side plates 5, the separating grid 1 supports a separating unit, generally designated by 8, which assumes an obliquely upwards and rearwards tilted position, as seen in the direction of flow A of the running water 2. The separating unit 8 comprises a number of juxtaposed alternate fixed and mobile grid bars 9 and 10, respectively. The grid bars are upended and preferably they are made from stainless steel or some other material of sufficient resistance in this connection.

Briefly, the fixed grid bars 9 are non-movably attached to the separating grid 1 whereas the mobile grid bars 10 are movably secured thereto, in a manner to be described in closer detail below. The number of fixed and mobile grid bars 9, 10 may be varied according to the desired width of the separating grid 1.

The fixed as well as the mobile grid bars 9, 10 are essentially straight as seen in their longitudinal extension and the bar edges turned towards the direction of flow A of the water are formed with collection and removal means 11. These means 11 are in the shape of depressions 12 and peaks 13 formed alternately in succession along essentially the entire length of the grid bars 9, 10, the depressions becoming deeper and the peaks higher and more pointed, as seen in the direction from the lower ends 14 of the grid bars 9, 10 to their upper ends 15. As appears from the drawings, the depressions 12 and the peaks 13 therefore are comparatively shallow and low, respectively, at the lower ends 14, in which area their configuration resembles that of small waves, and become increasingly more pronounced in

the direction towards the upper grid bar ends 15, in which area they have a step-like configuration.

When actuated by a drive unit generally designated by reference 16 and to be described in more detail further on, the mobile grid bars 10 of the above-described collection and removal means 11 serve the purpose of carrying the solid particles and objects 4 step by step upwards, out of the running water 2 and along the corresponding collection and removal means 11 of the fixed grid bars 9, up to a discharge means or outlet 17 positioned on the upper end of the separating grid, upstream from the upper ends 15 of the grid bars 9, 10. From this outlet 17, the particles and objects 4 are removed via a conveyor or the like, not shown in more detail, for further treatment/processing and/or use/deposition.

The mobile grid bars 10 are connected in the area of their upper part 18 to the drive unit 16 and in the area of their lower part 19 they are suspended in the lower part 20 of the separating grid 1 by means of a cradle, generally designated by reference 21. More precisely, according to the shown embodiment the mobile grid bars 10 are removably mounted in the area of their upper part 18 on two upper mobile cross beams 22. The cross beams 22 extend crosswise relative to the separating grid 1 underneath the side plates 5 and they are connected to the drive unit 16 in a manner to be described in more detail further on. In the area of their lower part the mobile grid bars 10 are similarly removably mounted on two lower mobile cross beams 23. These cross beams 23 are essentially similar to the upper cross beams 22 and like them they extend crosswise relative to the separating grid 1 underneath the side plates 5. In a manner also to be described in more detail further on, the lower cross bars 23 are connected to the cradle 21.

In turn, the fixed grid bars 9 are removably mounted between their ends 14, 15 on spaced apart, stationary

cross beams 24, in the present case on four such cross beams. Also these cross beams extend crosswise relative to the separating grid 1 underneath the side plates 5 while at the same time forming part of the frame structure of the separating grid 1.

In accordance with the two embodiments shown in the drawings and described herein, the above-mentioned cradle 21 is fitted with a suspension unit 25, one at each side of the separating unit 8. More precisely, the two suspension units 25 of the cradle 21 are placed in a protected position on the external faces 26 of the side plates 5 that are turned outwards, away from the separating unit.

In accordance with the embodiment illustrated in Figs 1 and 2, each suspension unit 25 comprises an elongate rocker arm 27 extending in the longitudinal direction of the separating unit 8, essentially in parallel with and vertically spaced from the mobile grid bars 10, as most clearly apparent from Fig 2. At the lower rocker arm ends 28, submerged into the running water 2, pivots 30 pivotally connect the rocker arms 27 to the lower end 29, likewise submerged in the water 2, of the separating grid 1.

In addition, in accordance with the embodiment of Figs 1 and 2, each suspension unit 25 comprises two rocker links 31 and 32. These extend in an essentially spaced apart, inter-parallel relationship essentially at right angles to the rocker arm 27 and to the mobile grid bars 10. At one of their ends, the upper ends 33, the two rocker links 31, 32 are articulated to the rocker arm 27 at a point intermediate the lower end 28 and the upper end 34 thereof, and at the opposite, lower rocker link ends 35, pivots 36 and 37 connect the links to the mobile grid bars 10.

The two suspension units 25 of the cradle 21, consisting of the rocker arms 27 and the rocker links 31, 32 and their associated pivots 30, 36, 37, are made from a

material that is suitable for their intended purpose, preferably like the rest of the separating grid 1 from stainless steel or the like. The pivots 30, 36 and 37 could consist of slide and/or roller bearings of suitable configuration and may be permanently lubricated and/or encapsulated to resist the environmental conditions of the water 2.

More precisely, one of the rocker links 31, 32, in the present case rocker link 32, is pivotally connected at one of its ends, the upper end 33, to the rocker arm 27, essentially in the area of the upper rocker arm end 34, and at its lower end 35 to the mobile grid bars 10 essentially in the area of the lower one-third of the bars as calculated from the lower bar ends 14. The other rocker link 31 is pivotally connected at one of its ends, the upper end 33, to the rocker arm 27, the point of connection essentially located in the area halfway between the upper and lower ends 28, 34 of said arm, whereas at its opposite lower end 35 said link is pivotally connected to the mobile grid bars 10, essentially in the area of the lower grid bar ends 14. The above-defined location of the pivot points interconnecting the rocker arms 27, the rocker links 31, 32, and the grid bars 10 is but one of several possible examples and could of course be varied.

In accordance with the shown embodiment, the two suspension units 25 consisting of the rocker arms 27 and the rocker links 31, 32 are directly or indirectly interconnected by means of the two lower mobile cross beams 23, on which the mobile grid bars 10 are mounted in the area of their lower part 19.

In accordance with the second preferred embodiment illustrated in Fig 3 each suspension unit 25 comprises three main components, viz. a rod member 45, a tubular member 47 and a transmission means 47.

The rod member 45 preferably is configured as a cylindrical piston rod the lower end of which, 48, which

is submerged in the running water 2, is pivotally connected to the lower end 29 of the separating grid 1 by means of a pivot 49.

For adaptation to the configuration of the rod member 45, the tubular member 46 preferably is in the form of a bushing which is mounted on the piston rod for concentric sliding movement thereon in any suitable manner allowing it to be displaced longitudinally to and fro along the piston rod.

The rod and tubular members 45, 46, like the rocker arm 27 in accordance with the embodiment of Figs 1 and 2, extend in the longitudinal direction of the separating unit 8, see Fig 3, essentially in parallel with the mobile grid bars 10 and spaced above the latter.

The third main component of the suspension unit 25 in accordance with Fig 3, viz. transmission means 47, is fixedly connected between the tubular member 46 and the mobile grid bars 10. More precisely, the transmission means 47 in this case is configured essentially as an upright trapezoid and extends essentially vertically and obliquely, say at an angle of 45-60°, to on the one hand the bearing unit formed by the rod and tubular members 45, 46 and on the other to the mobile grid bars 10. The two opposite parallel sides 50, 51 of the transmission means 47 preferably are fixedly secured to the tubular member 46 and the mobile grid bars 10, respectively, in any suitable manner, such as by welding, riveting, bolting etcetera.

It should be appreciated that the shape and inclination of the transmission means 47 as described above are not the only possible ones. The essential feature is that it operates as a moment-resisting and rigid transmission element between the bearing unit formed by the rod and tubular members 45, 46 and the mobile grid bars 10.

Also in accordance with the embodiment of Fig 3, the components of the two suspension units 25 of the cradle

21, consisting of the rod and tubular members 45, 46 and the transmission means 47 including their associated connecting means, naturally are made from a material that is well suited for their intended application, preferably from stainless steel or the like. Also in this case the joints 49 may be made from slide and/or roller bearings, and the bearing units formed by the rod and tubular members 45, 46 may be configured in a corresponding manner or as linear ball bearings etcetera. Irrespective of the bearing type, the bearings may be of a permanent-lubricated type and/or be encapsulated in order to resist the severe environmental conditions in the running water.

In order to produce the motion of the mobile grid bars 10, the drive unit 16 comprises an electric drive motor 38, which is mounted on the frame structure of the separating grid 1, at the upper part thereof. On the drive motor 38 is mounted a gear box 39 having two coaxial and oppositely directed drive shafts 40. The drive shafts are rotationally mounted in bearings 41 on the side plates 5 and extend through said plates. Externally of the side plates 5 each drive shaft 40 actuates its respective one of two identical eccentric mechanisms 41. Each eccentric mechanism 41 is coupled to a transmission means 42 of essentially triangular configuration made from sheet metal or other suitable material, preferably stainless steel or the like. In turn, the transmission means 42 are connected to the two upper mobile cross beams 22 on which the mobile grid bars 10 are mounted in the area of their upper part 18.

In this manner the mobile grid bars are actuated, and in turn these grid bars set the two suspension units 25 in motion. The sought-after step by step conveyance of the solid particles and objects 4 up to the outlet 17 is thus achieved.

Two presently particularly preferred embodiments of the invention have been described and illustrated herein.

10

However, the invention must not be regarded as restricted to these embodiments but could be varied in many ways within the scope of the claimed protection as defined in the appended claims.

5

CLAIMS

1. A separating grid for collection and removal of solid particles and objects (4) present in running water (2), said grid being equipped with a separating unit (8) arranged in a position of inclination obliquely upwards, rearwards in the direction of flow (A) of the water, and comprising alternate fixed and mobile grid bars (9 and 10, respectively) formed with collection and removal means (11) on those grid bar edges that are turned towards the direction of flow (A) of the water (2), said mobile grid bars (10) being connected to a drive unit (16) in the area of their upper parts (18) and arranged to be actuated by said unit in order to draw the solid particles and objects (4) step by step out of the water (2) and carry them along the fixed grid bars (9), up to an outlet (17), c h a r a c t e r i s e d by suspending the mobile grid bars (10) in the area of their lower parts (19) from a cradle (21) disposed at the lower part (20) of the separating grid (1), said cradle comprising suspension units (25) on both sides of the separating unit (8).

2. A separating unit as claimed in claim 1, w h e r e i n each suspension unit (25) comprises on the one hand a rocker arm (27) the lower end (28) of which is articulated to the lower end (29) of the separating grid (1), and on the other two rocker links (31, 32), one (33) of the ends of which is articulated to the rocker arm (27) at a point intermediate the upper and lower ends (28, 34) of said arm and the opposite ends (35) of which are articulated to the mobile grid bars (10).

3. A separating grid as claimed in claim 2, w h e r e i n the rocker arm (27) extends essentially in parallel with and spaced above the mobile grid bars (10), and wherein the rocker links (31, 32) extend essentially in inter-parallel relationship and essentially at right

angles to the rocker arm (27) and to the mobile grid bars (10).

4. A separating grid as claimed in claims 2 and 3, w h e r e i n one (32) of the rocker links is pivotally
5 connected at said one (33) of its ends to the rocker arm (27) essentially in the area of the upper rocker arm end (34), and at said opposite end (35) to the mobile grid bars (10) essentially in the area of the lower one-third of the bars as calculated from the lower bar ends (14),
10 and wherein the other rocker link (31) is pivotally connected at said one end (33) to the rocker arm (27) at a point located essentially in the area midway between the upper and lower ends (28, 34) of said arm, whereas at its said opposite end (35) said link is pivotally connected
15 to the mobile grid bars (10), essentially in the area of the lower grid bar ends (14).

5. A separating grid as claimed in claim 1, w h e r e i n each suspension unit (25) comprises a rod member (45), the lower end (48) of which is articulated
20 to the lower end (29) of the separating grid (1), as well as a tubular member (46), which is mounted on the rod member (45) for longitudinal sliding movement thereon, and a transmission means (47), which is stationarily mounted between the tubular member (46) and the mobile
25 grid bars (10).

6. A separating grid as claimed in claim 5, w h e r e i n the rod and tubular members (45, 46) extend essentially in parallel with the mobile grid bars (10) and are spaced above said bars, said rod member (45)
30 being configured as a piston rod and the tubular member (46) as a bushing concentrically mounted on the piston rod for sliding motion thereon.

7. A separating grid as claimed in claims 5 and 6, w h e r e i n said transmission means (47) is configured
35 essentially as an upright trapezoid and extends obliquely relative to on the one hand the rod member and the tubular member (45 and 46, respectively) and on the other

to the mobile grid bars (10), said transmission means (47) being fixedly secured to the tubular member (46) and to the mobile grid bars (10) at its oppositely positioned, parallel sides (50, 51).

5 8. A separating grid as claimed in any one of the preceding claims, w h e r e i n in the area of their upper part (18) said mobile grid bars (10) are removably mounted on at least one upper mobile cross beam (22) and in the area of their lower part (19) they are removably
10 mounted on at least one lower mobile cross beam (23), and wherein the suspension units (25) are interconnected via the lower mobile cross beam or cross beams (23).

9. A separating grid as claimed in any one of the preceding claims, w h e r e i n the drive unit (16)
15 drives at least one eccentric mechanism (41), said eccentric mechanism arranged (41) to actuate the mobile grid bars (10) by means of a transmission means (42) connected to the upper mobile cross beam or cross beams (22), said mobile grid bars (10) in turn arranged to
20 directly set the suspensions units (25) in motion, all to produce the desired step by step collection and removal of the solid particles and objects (4) and conveyance thereof to the outlet (17).

10. A separating grid as claimed in any one of the
25 preceding claims, comprising a frame structure including two spaced apart, essentially parallel side plates (5) receiving said separating unit (8) between them, the suspension units (25) being positioned in a protected position on the faces (26) of the side plates (5) that
30 are turned away from the separating unit (8).

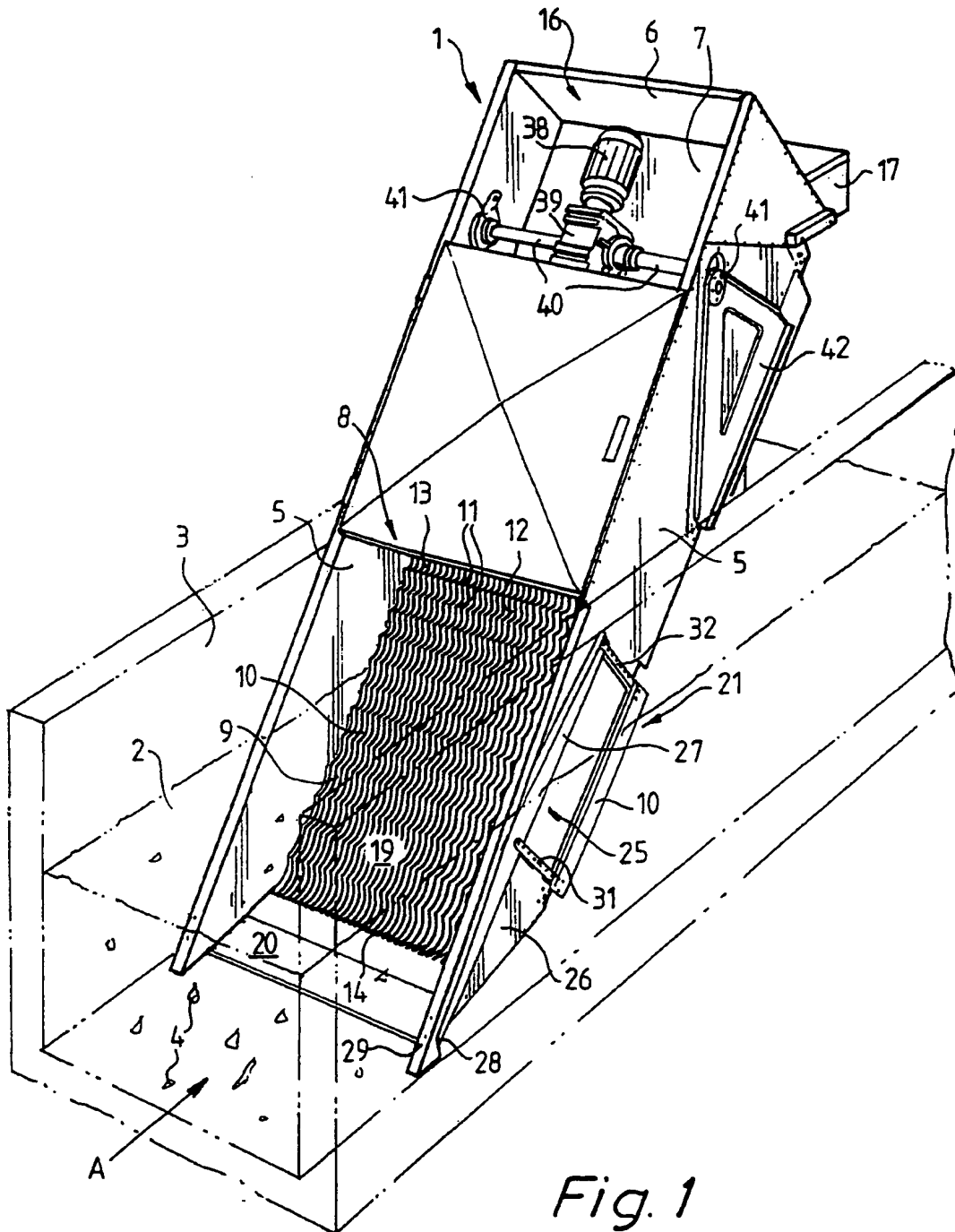
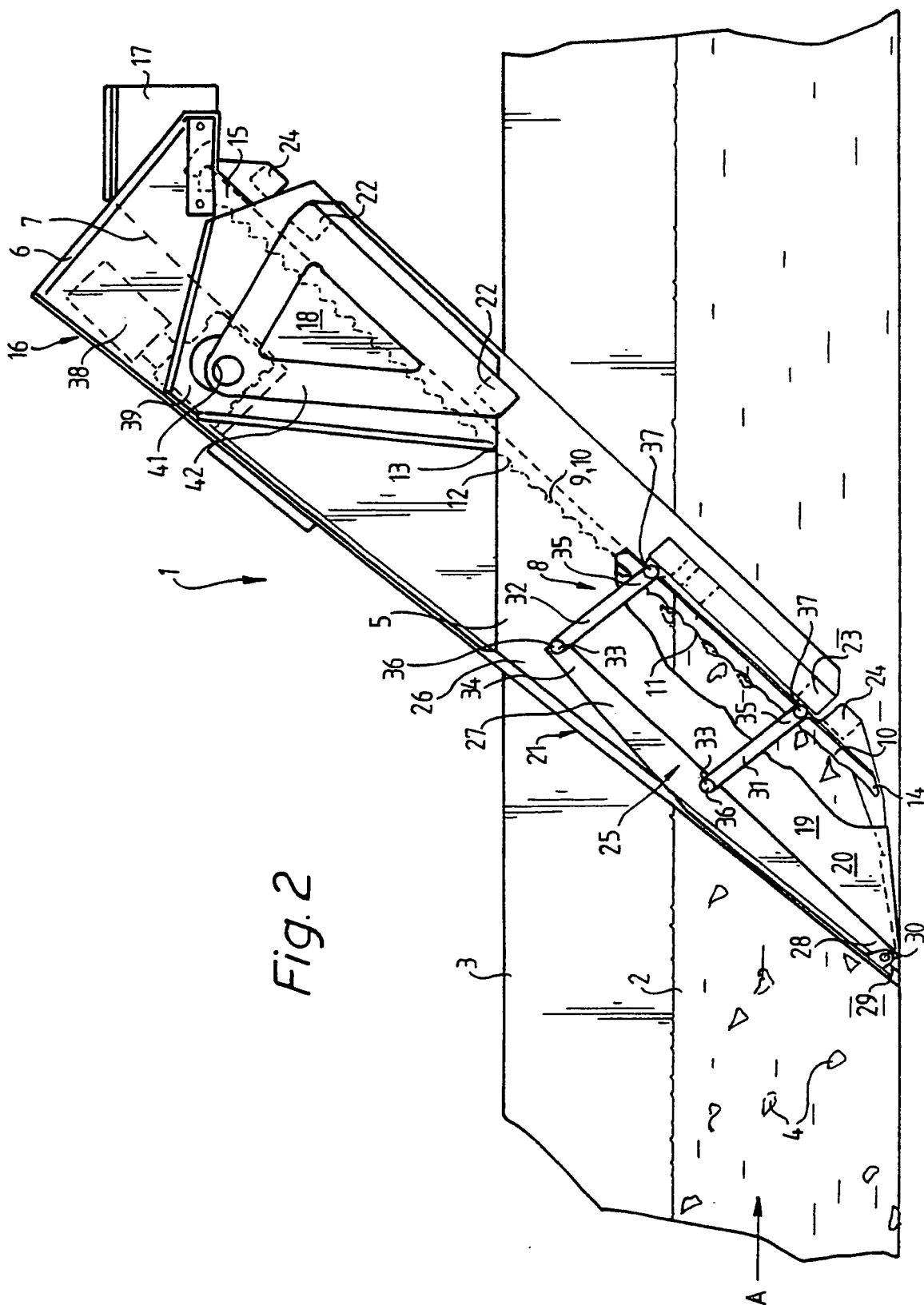


Fig. 2



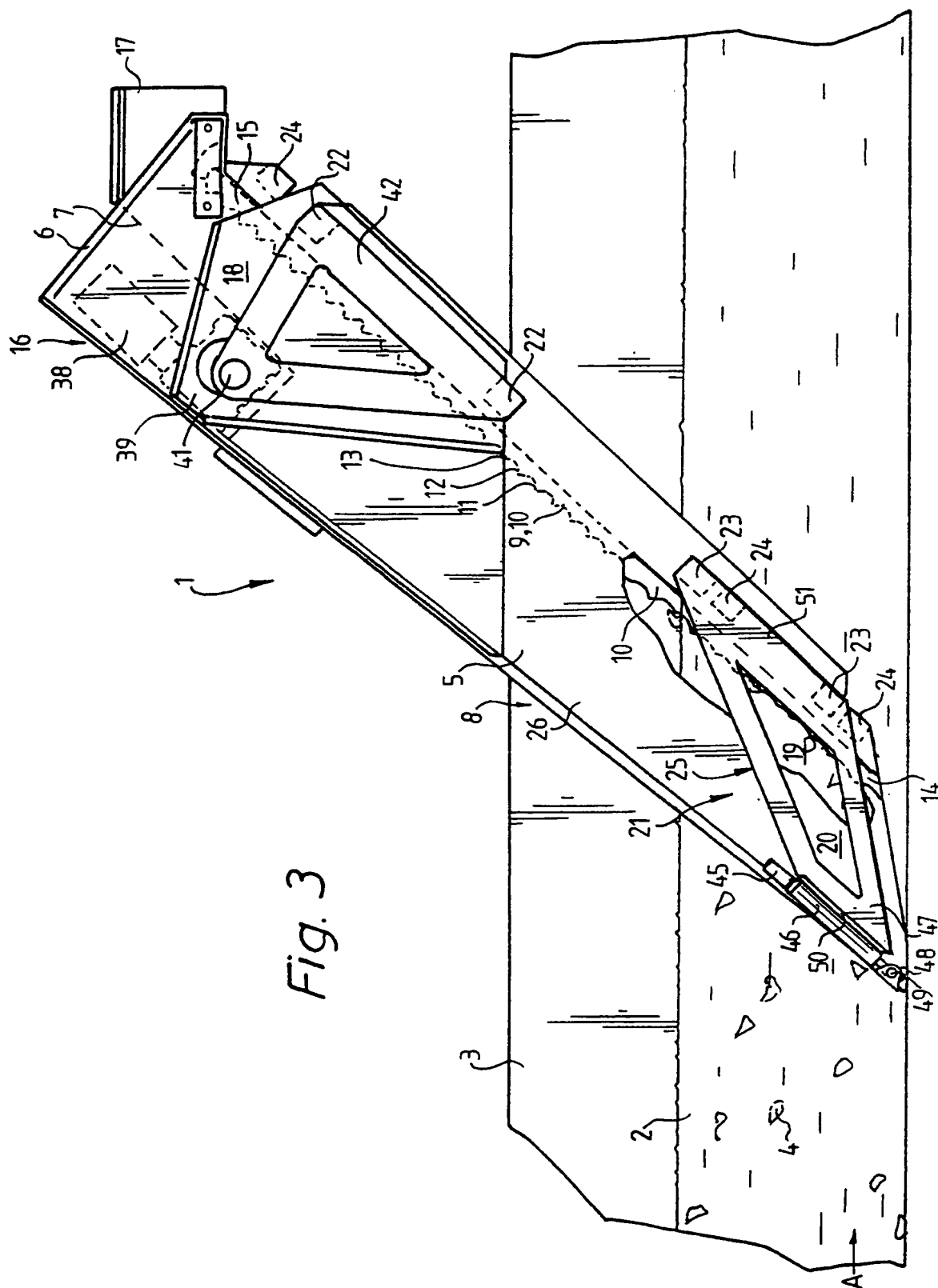


Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/00228

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: E02B 5/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: E02B, E03F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	SE 470102 B (MELLEGARD VA MASKINER AB), 8 November 1993 (08.11.93) --	1-10
A	GB 2225962 A (O. MILESON), 20 June 1990 (20.06.90) --	1-10
A	EP 0712968 A2 (PICATECH AG), 22 May 1996 (22.05.96) -- -----	1-10



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See patent family annex.

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Date of the actual completion of the international search

17 May 1999

Date of mailing of the international search report

14 -06- 1999

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INTERNATIONAL SEARCH REPORT
Information on patent family members

03/05/99

International application No.

PCT/SE 99/00228

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
SE 470102 B	08/11/93	AT 131234 T AU 652645 B AU 1910592 A DE 69206614 D,T DK 586493 T EP 0586493 A,B ES 2083747 T GR 3019182 T HK 1001333 A SE 9101663 A US 5456826 A WO 9221824 A	15/12/95 01/09/94 08/01/93 25/07/96 22/04/96 16/03/94 16/04/96 30/06/96 00/00/00 30/11/92 10/10/95 10/12/92
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EP 0712968 A2	22/05/96	SE 505169 C SE 9303243 A	07/07/97 06/04/95